Ontario fish and wildlife Review

Vol. 18, No. 1, 1979

Read all about the remarkable nature of Lake Erie, wetlands and registered traplines.

Frank Maher illuminates the thinking behind the thinking behind SPOF, a name you are going to hear again and again and again.

Bill Lannin and Peter Liew announce a better world for eels, and Dianne Kolenosky for Lake Ontario—her Spof is no spoof.

Registered traplines—that's another success story, thanks to some good men, including the author, Milan Novak.

Cover photo of American bittern by Peter van Staam.

Ontario fish and wildlife Review

ISSN 0030-2929

VOL. 18, No. 1 SPRING, 1979

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Ontario Fish and Wildlife Review is published quarterly by the Ministry of Natural Resources (Fisheries Branch and Wildlife Branch), Toronto, Ontario, M7A 1W3. Material herein may be reprinted provided credit is given to the author and this publication. Editorial committee: F. P. Maher, J. L. Tiller, A. A. Wainio and L. Whistance-Smith.

The goal of the Ministry of Natural Resources is to provide opportunities for outdoor recreation and resource development for the continuous social and economic benefit of the people of Ontario, and to administer, protect and conserve public lands and waters.

Ontario
Ministry of Natural Resources
Hon. James A. C. Auld
Minister
Dr. J. K. Reynolds
Deputy Minister

One-year subscription rate: $2.50 in remittance payable to Treasurer of Ontario Information Services, Ministry of Natural Resources, Toronto, Ontario M7A 1W3

EDITORIAL

S.O.S.

For years our streams have taken a beating—converted into drainage ditches, covered over by subdivisions, channelized by engineers, polluted by municipalities, and dried up by poor land practices.

A co-operative effort by several private organizations is hoping to stem the tide of abuse inflicted on our streams.

Aptly named S.O.S. (''Save Our Streams''), it brings together the Federation of Ontario Naturalists and the Toronto Anglers' & Hunters' Association, backed by the Canadian National Sportsmen's Shows to make it a province-wide effort.

The program has been explained as follows: ''It is based on the premise that concerned people, naturalists and conservation clubs, community associations, sportsmen and schools are willing to adopt a stream in their area and accept a personal responsibility for its rehabilitation.''

Special kits for groups who have adopted streams have already been prepared and handed out. The kits provide information on environmental law, landowner liaison, obtaining funds and other guidelines. Technical advisors are available to each group.

The S.O.S. program has four phases: assessment and clean-up, planting and fencing, construction of habitat enhancing devices, and ongoing surveillance and maintenance.

In a recent S.O.S. workshop it was gratifying to see anglers and naturalists sitting down together to learn about stream improvement techniques and plan more work for the future. All of them said their field work has been rewarding, educational and fun.

What is most significant about S.O.S. is that it is solely a private citizens' effort. To those people within the government who have been fighting to save our streams for years, it is most encouraging that there is now a citizen campaign to complement government efforts.

The Ministry of Natural Resources has actively assisted the program and gives technical advice whenever called upon.

The idea is not new. Ontario has a long tradition of anglers working constructively on streams. In many parts of Ontario fish and game clubs have carried out stream improvement works, built spawning beds, and assisted migratory fish over barriers.

Ontario is blessed with a rich heritage of streams that are worth saving for future generations. The urbanization and industrialization of the province may harm more of our rivers than anyone can imagine.

The S.O.S. campaign gives all interested people an opportunity for direct action. No longer will citizens be able to complain about not being able to do anything. They can now adopt and rehabilitate a local stream.

VOL. 18, No. 1 ONTARIO FISH AND WILDLIFE REVIEW SPRING, 1979

INTROSPECT

A personal opinion
not necessarily endorsed by
the Ministry of Natural Resources

Lake Ontario status report

by D. P. Kolenosky
Supervisor
Lake Ontario Fisheries Assessment Unit

As we enter the 21st Century and look at Lake Ontario's magnificent fishery, it is hard to believe the lake was considered a write-off in 1980. Just 20 years ago it was one of the most polluted lakes in the world.

The Strategic Plan for Ontario Fisheries (SPOF) served us well through the 1980s and 1990s and is still our guiding principle. It took a lot of courage and foresight to rehabilitate Lake Ontario.

Contaminants must have been the most discouraging problem in 1980 and dioxin was the straw that broke the camel's back. When something so lethal showed up in the fish, even in minute quantities, many people became worried. After all, Lake Ontario provides drinking water for many millions of people. Like the miner's canary, the fish were warning us the lake was not healthy and something had to be done. The public finally demanded action. The input of contaminants was stopped at the source and the lake was allowed to cleanse itself.

Sea lamprey control of the 1970s was effective in reducing lamprey wounding and the stocked salmonids flourished. Phosphorus control in detergents and sewage discharge reduced the growth of algae on spawning shoals. Now lake trout are reproducing naturally in Lake Ontario for the first time in 50 years. Some natural lake trout shoals were found in the western basin off Port Credit and Hamilton harbour. But the trout seemed just as happy with the artificial shoals created off Clarkson in the late '70s by Gulf Oil. In fact, it was such a popular PR item that Ontario Hydro got on the bandwagon to produce some more off their nuclear generating stations at Wesleyville and Darlington.

Closely related to the lake trout, the backcross created in the splake program in the mid-1970s proved to be the superior fish that scientists claimed it would be—early-maturing and fast-growing and with a shallower distribution that made it a dynamite fish for the small-boat angler.

It did not take long for rainbow trout to establish themselves in the Credit River once fishways were installed to bypass the dams. The last year of rainbow stocking in the Credit was 1982. Since then a fishery to rival that of the Ganaraska River has developed, and all based on natural reproduction.

Coho salmon are now imprinted on a special chemical to home on bays and tiny streams, thus making them more accessible to anglers and keeping them out of the rainbow trout streams.

Brown trout were stocked around the landfill parks created by the Metropolitan Toronto and Region Conservation Authority. Significant natural reproduction was observed by 1990 and stocking was phased out so that mother nature could take over.

A closure on eastern basin commercial whitefish fishing was finally effected by 1980. The long-awaited new hatchery became operational by 1985 and Lake Ontario started receiving an annual stocking of one million whitefish fingerlings. Commercial fishermen were permitted to resume harvest of whitefish in 1990, using deepwater trapnets, but limited by a quota. In the interim, a charter-boat fishery had developed for lake trout in the eastern basin. Innovative commercial fishermen now combine the two by taking anglers trolling for lake trout on the way out to lift the whitefish trapnets so that even the unsuccessful angler can come back with a fish.

Bay of Quinte clarity improved from the late 1970s but the initial flurry of walleye resurgence fizzled out. Underwater plants were not reestablishing themselves as fast as had been hoped for. Here, a new field of "aquatic sediment landscaping" has evolved in which rooted aquatic plants are raised in underwater flats in the Kawarthas and transported to the Bay. This has provided employment for divers, and the recovered walleye population supports a recreational fishery that attracts anglers from Montreal to Toronto.

Such a magnificent recovery in 20 years.

Impossible? Only if Lake Ontario had really been written off in 1980.

Two trappers visit underwater sets.

The registered trapline system in Ontario

by Milan Novak

Supervisor of Fur Management, Wildlife Branch

THE registered trapline system is the most successful large-scale wildlife management program in Ontario to date. How did this come about?

The basic reason for its success may be that it adopted the age-old hunting territory concept. Anthropologists' studies of primitive societies have found they had partitioned areas for hunting and food gathering. The hunting territories were generally dominated by a resident band of closely related kinsmen. Such a hunting system was in existence in Canada when the first explorers came here, and to some extent is still found today in remote sections of northern Ontario.

The fact that 87 per cent of Ontario's land is owned by the Crown facilitated the development and persistence of the registered trapline program throughout the Province. Crown land has always been, and still remains, sparsely populated.

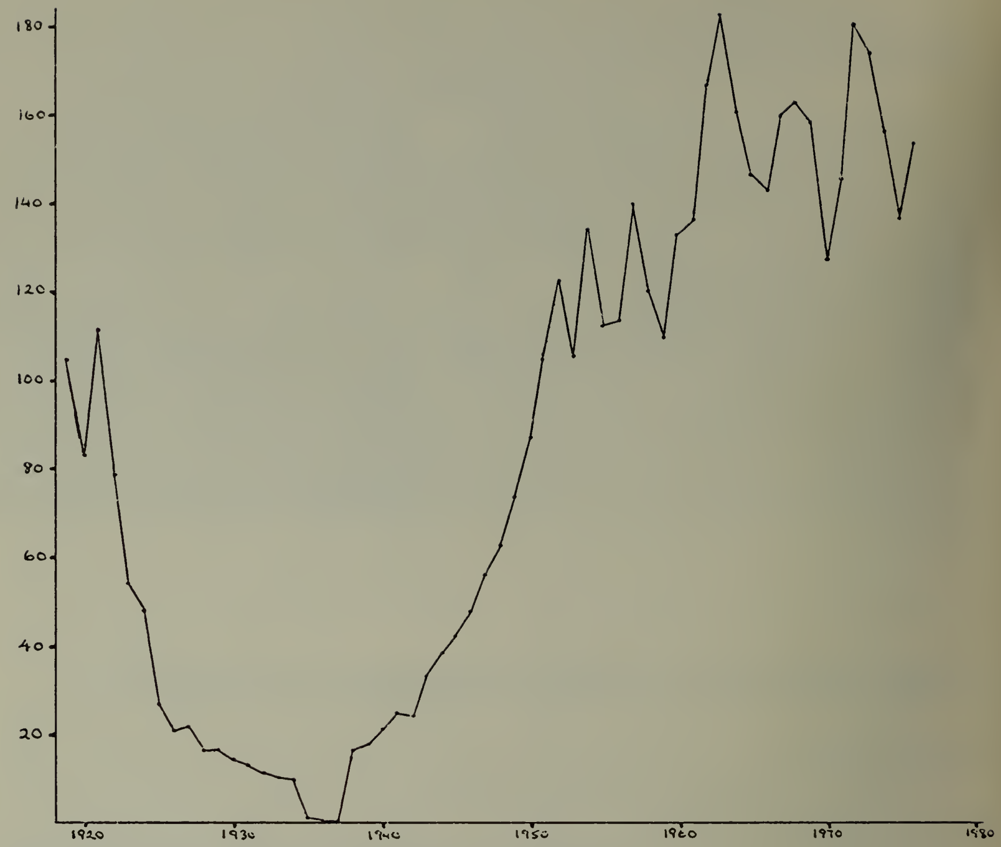
Compared with hunters (458,000) and sport fishermen (2,759,000), relatively few people (14,725) trap or want to trap, making it easier to accommodate those who do. On private land much trapping is done but it has no registered traplines because the landowner controls access.

Quebec tried a similar system of assigning exclusive rights for hunting and fishing but discontinued it because it was considered discriminatory to the public in general.

In Europe the revier system is in operation; it has been beneficial to game management but is generally exclusive to the privileged rich. The important difference between Europe and Quebec (or all of North America) is that in Europe the common public cannot hunt. The hunter densities in Europe are low and often comparable to trapper densities in Ontario. Thus, another major reason for the success of the trapline system is the small number of participants.

Registered traplines in Ontario are units of Crown land that vary in size from about five square kilometres (two square miles) to the largest one, on the coast of Hudson Bay, which is some 900 square kilometres (about 350 square miles). The average trapline is 109 square kilometres (42 square miles).

Ontario has 2,800 registered traplines of which 36 per cent are trapped by 3,000



The number of beaver pelts (in thousands) sold in Ontario.

"Treaty" Indians. Since the Indians tend to hold proportionately more of the larger, northern traplines, they trap about half the trapline area.

Trapping is the most physically and technically demanding form of hunting, and in most instances it is a solitary activity. Companionship in the field is not the important consideration it is with hunters. Trapping rights or territories have always been jealously guarded. For these reasons few people become trappers and they tend to be older men.

Relatively speaking, fur gradually became less important in the economy of Ontario in the 19th century and this decline continued into the 20th century. Following 1920, the beaver population, king-pin of the fur trade, began to decline. It is not really understood why, because today's harvests are as great, if not greater, than in 1920, yet the beaver population is not declining. The decline was probably caused by a combination of several factors—less suitable range conditions, progressive over-trapping of accessible areas and, perhaps, disease problems.

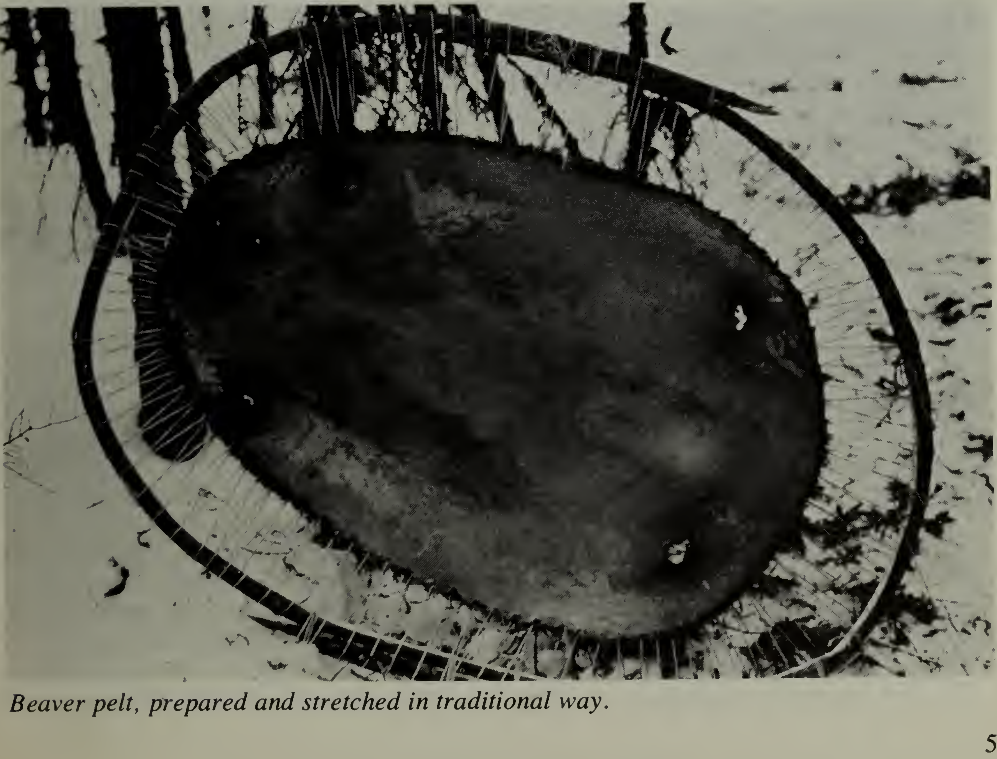
The depths to which the resource was plunging forced the government to greater enforcement efforts to control poaching and the illegal purchase and sale of pelts.

The first trapping licences were issued in 1914. For $5 a person could trap anywhere south of the French and Mattawa Rivers, or between the French and Mattawa and the CNR lines, or north of the CNR lines. As a result trappers had large trapping areas and this resulted in competition and friction between trappers.

Other management measures were also started at this time. Most notable were the principles of sealing pelts and assigning quotas to trappers for certain species. Fur dealers also were licensed. More game wardens were hired and the fur industry became a major concern of the government.

Kelly Evans, the last Game Commissioner

Indian trappers' camp in northern bush.



Beaver pelt, prepared and stretched in traditional way.

in Ontario, is the man given credit for the concept of drawing traplines on maps back in 1911. However, it was Frank Butler, Game Commissioner in British Columbia, who began implementation of this radical concept in 1926.

In the east before 1940, Jimmy Watt, a Hudson's Bay Company factor at Rupert's House, started to promote the idea of the Quebec Beaver Preserves and of assigning harvest quotas (within those preserves) based on the number of beaver houses. When this became an obvious success, the Company and the Federal Government, through the Indian Affairs Branch, began to promote this management concept.

Old trappers remember discussing the need for some form of trapline registration in Ontario in 1943. By 1947 traplines were established over much of Ontario's Crown land.

WILD FUR HARVEST, 1977-8

Numbers of pelts taken by licensed trappers

Furbearers	Registered Traplines	Ontario Total**	Average Price*
Beaver	100,089	148,772	$20.84
Mink	13,216	20,727	13.97
Marten	37,281	39,195	19.47
Otter	7,287	8,664	64.93
Fisher	2,319	2,711	100.41
Lynx	1,675	1,732	301.00
Bobcat	9	17	126.38
Muskrat	90,274	486,285	5.42
Raccoon	4,335	63,435	23.31
Squirrel	2,711	4,169	1.48
Weasel	2,600	3,771	1.35
Colored fox	5,682	14,312	64.12
Arctic fox	208	208	37.06
Timber wolf	218	329	83.65
Coyote	714	3,272	42.31
Black bear	104	249	50.60
Wolverine	10	11	164.60
Skunk	26	233	3.29
Grey fox	—	1	64.12
Polar bear	24	24	601.90

* The total value exceeded $11 million.

** Totals do not include the furs taken by hunters as follows: 31,490 raccoon, 72 squirrel, 24 weasel, 1,937 colored fox, 3 Arctic fox, 151 timber wolf, 1,234 coyote, 39 black bear, and 1 wolverine.

The men most responsible for this in the former Department of Lands and Forests were Dr. W. J. K. Harkness, Chief of Fish and Wildlife, 1946 to 1960; Dr. C. H. D. Clarke, Supervisor of Wildlife and later Chief of Fish and Wildlife, 1944 to 1971; Jack Grew, Supervisor of the Fur Section, 1947 to 1967; and Con Ducharme, Provincial Fur Management Officer, 1948 to 1973.

The original trapline maps were drawn in consultation with trappers at many meetings held throughout the province. The question "Where do you normally trap?" was asked over and over again. Lines were drawn on maps and tough decisions were made when no common boundary could be agreed upon.

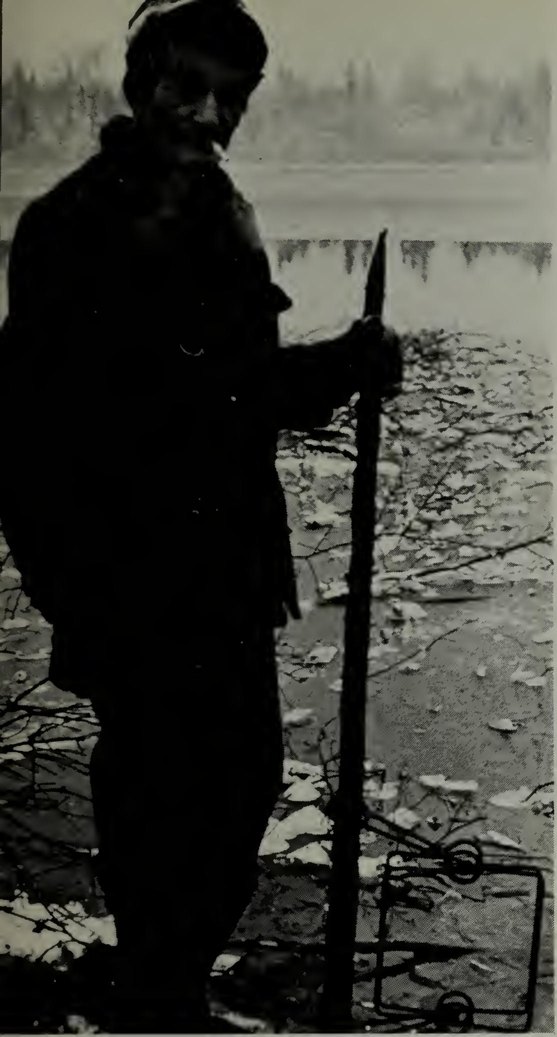
It is amazing how thoroughly and quickly the job was done. In 1950 the first maps were officially registered at Queen's Park (O. Reg. 179/50), and the system persists to this day.

The system worked well from the start. It worked well because it satisfied people's aspirations to hold a hunting territory, and it enabled the animals to prosper since it allowed the government to set specific harvest or management goals for specific areas. It also eliminated competitive trapping. This protection enabled the trapper to plan for the future and to tailor his harvests accordingly.

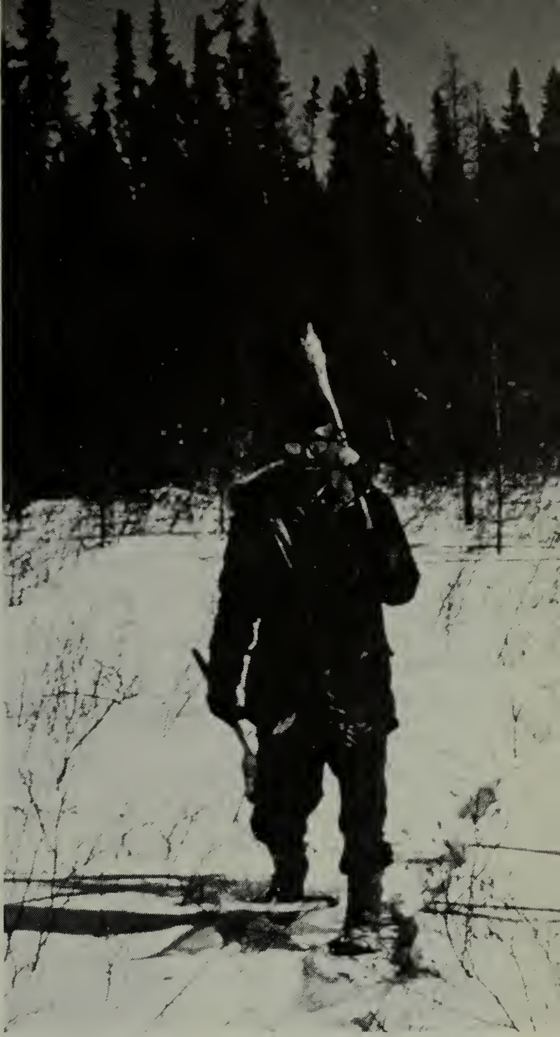
The system provided for the control of harvest by area-specific quotas where necessary, rather than by season. Fur trapping seasons are generally set for the period when pelts are sufficiently prime for the fur trade. Thus we have seasons three to six months long and the assigned quotas can be for any specified number of a particular species. This is unlike game management which generally relies on seasons to control the harvests over vast areas of the range.

Several problems did arise with traplines. Some trappers did not trap and only held the traplines for cabin privileges, using them for vacations or recreational hunting. Some bought traplines and got others to harvest the fur.

Many trappers began to consider traplines as private property and sold their traplines to the highest bidder. It became difficult to control this practice, especially in the 1950s and early 1960s when many traplines were vacant because of the depressed fur markets



Indian trapper with Conibear trap.



Indian trapper snowshoes his trapline.

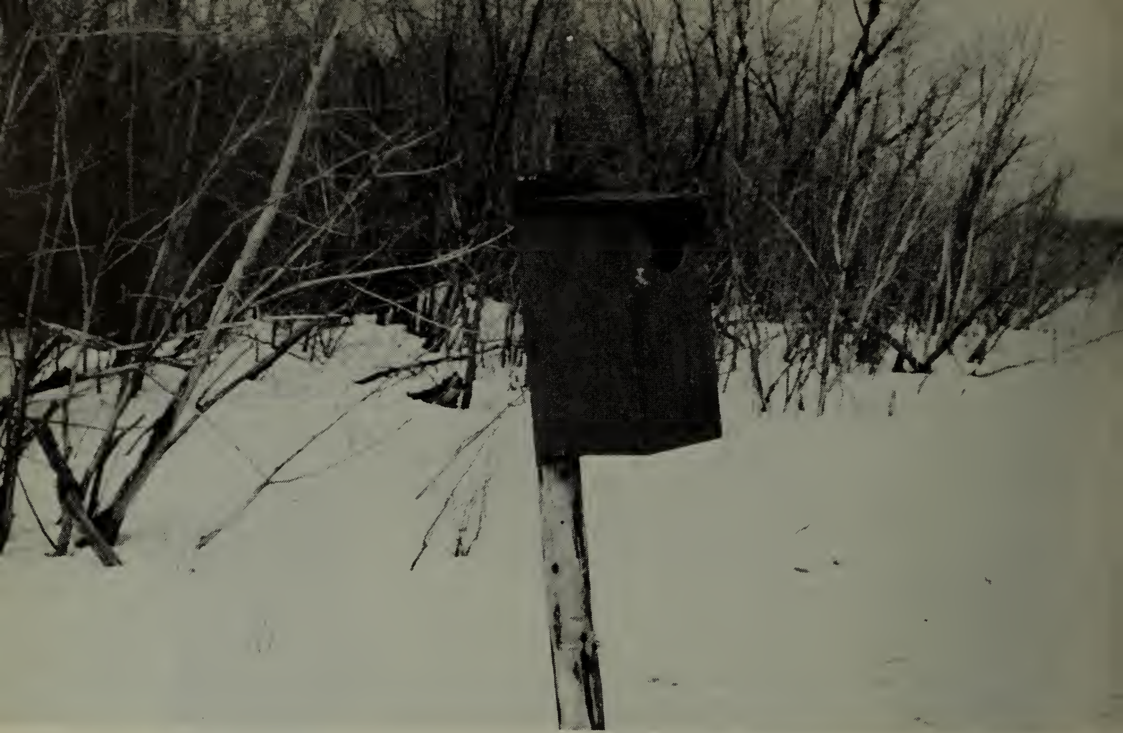
and the lack of interest in trapping. The Department, too, began to switch its priorities by the mid-1950s to deer, moose, caribou and waterfowl, and less interest was shown in fur management at main office and field levels.

In recent years there has been a renewed interest in trapping and fur management. Instead of vacant traplines, there are waiting lists. Traplines are no longer sold, and attempts are made to select the best trappers. This can only be brought about by the Ministry of Natural Resources firmly controlling the transfer of traplines. Today, trappers must harvest at least 75 per cent of their quota or they chance losing their rights to trap on all or portions of their traplines.

Trappers and local councils are increasingly brought into the picture in, for example, selecting trappers for vacant lines or deciding what to do about inactive trappers. This is a form of management whereby managers solicit and expect to get advice on setting quotas and seasons and in selecting trappers for vacant lines.

After all, the trapper is the primary manager of the furbearers on his trapline. He makes the decisions where to set traps and how many beaver he will take out of a particular house. He has a personal interest in the productivity of the furbearers on his line. If he does not harvest the furbearers in accordance with good management principles, he may expect a reduction in the production of furs.

Through the co-operation of government and trappers, the registered trapline system is firmly established as a fine example of wildlife management, and Ontario's fur resource thrives.



Test case: Wood duck nest box on pole in Isaac Lake.—Photos by G. R. Harris

Artificial trees for wood ducks

by W. J. Grieve
Conservation Officer, Owen Sound District

PEOPLE who know the Bruce peninsula may be interested in the steps taken to increase the production of wood ducks on Isaac Lake, one of a series of weedy, shallow lakes which support good populations of pike, bass and waterfowl.

Isaac Lake lies west and north of Wiarton within the Rankin Resource Management Area in which 13,703 ha (53 square miles) of public land adjoining the lakes and rivers are managed under agreement by the Sauble Valley Conservation Authority and the Ministry of Natural Resources.

Boats have several access points and canoeists can paddle from Sky Lake to Sauble Falls with short portages. The woodlands and scattered clearings throughout the area are good spots for ruffed grouse, woodcock, varying hare and white-tailed deer.

Wood duck populations on Isaac Lake appeared to diminish after 1961 when raising the water level caused suitable nesting trees to rot one by one and fall into the water.

By 1971, when 43 nest boxes were built to aid the failing wood duck population, there was no choice but to place many of them on trees growing on dry land, some as much as half a kilometre from the water. Tin sleeves were placed around the trunks to limit predation.

In the next four years, more trees fell into the water or had their rotted tops blown off by the wind. A number of the ''predator proof'' sleeves fell off, and claw marks at the nest box entrances indicated predation by raccoons.

To sum up the four years, only 11 nest boxes were used by wood ducks and only six boxes produced wood duck broods. Many of the boxes were used by owls, hooded mergansers, tree swallows, starlings and other bird species.

It was decided to locate new nest boxes over water, and this presented a problem; we

Cutting hole in ice.

Placing pole through ice.

Attaching cement block to pole.

Driving pole into lake bottom.

would have to plant artificial trees, but how? The bottom of Isaac Lake is soft, deep muck; it sits on a hardpan of various materials and is covered with a thick layer of spongy peat. Furthermore, the shore area is boggy and difficult to cross except when frozen.

In March, 1975, six poles from 5 to 6 m in length were cut from tall, slim ash. They were positioned through holes in the ice and driven down until they hit solid bottom. To each pole, a cement block weighing 18 kg (40 pounds) was tightly affixed at ice level. The poles were then pounded down farther until the cement blocks rested on the bottom.

The cement block acted like both an anchor and a float. It held the pole down and also prevented it from sinking deeper in extremely soft locations. If heaved up by the ice, it settled the pole to its original position and held it vertical.

The poles were placed from 60 to 120 m from shore, well out in open water when the ice melted. Wood duck nest boxes were attached to the poles and checked by snowmobile in the following winters.

Three boxes were used by wood ducks in 1975 and all six boxes were used in 1976. In 1977, three boxes were used by wood ducks and two by mallards, and one box had evidence of occupancy by paper wasps. No attempt was made to count incubated eggs or calculate the number of eggs hatched from the quantities of broken shells. The offshore locations apparently acted as a deterrent against the use of the boxes by unwanted species.

To follow up the success of the test boxes on the test poles, 43 wood duck nest boxes were erected on offshore poles in March, 1978.

The earlier nest boxes had been built of barn boards but the latest group was made from half-inch plywood and stained a dull brown color which has been shown to be more acceptable than raw wood or varnish finishes. Each box is 8'' × 8'' × 10'', the size recommended by the Canadian Wildlife Service.

We hope to have good results.

More training, fewer accidents

A total of 38,500 new hunters was trained under the Hunter Education Program in 1978, bringing to 490,798 the number of hunters trained in Ontario since training began in 1957. The 1978 hunt resulted in 68 accidents, including eight fatalities. Accidents have been decreasing fairly steadily since 1960 when the first complete records showed 154 hunting accidents, including 36 fatalities.

Fish plantings

More than six million hatchery-reared fish were planted in Ontario waters in 1978. The total included more than a million each of brook trout, rainbow trout and maskinonge and more than one and one-half million lake trout. Salmon plantings numbered 594,000.

Wetlands are essential for education and scientific research.

Lowdown on wetlands

by L. M. Rowntree
Biologist, Wildlife Branch

FROM the tundra of the far north to the vineyards of Niagara, Ontario presents an array of different landforms, and of these the least appreciated are the wetlands. Since the first settlements, wetlands have been thought of as wastelands and drained and filled in the name of progress. Latter-day entrepreneurs stepped up the tempo of destruction and only a fraction of the wetlands in southern Ontario have escaped conversion to farmland, townsites and industrial parks.

The entire community has suffered a great loss in natural resources because wetlands have a host of natural functions which are vital to the environment. Our valuable wetlands have been wasted.

Originally 2.3 million ha (5.7 million acres) of wetlands existed in southern Ontario. Today only 276,000 ha (683,000 acres) remain south of the Precambrian Shield.

What are wetlands?

A wetland is land that is seasonally or permanently covered by shallow water. The presence of water creates soils which have special properties and favors the dominance of water-adapted plants.

As a rule a maximum depth of two metres is set as the deepwater boundary of a wetland since emergent plants seldom grow beyond that depth. Extensive parts of river flood plains qualify as wetlands, as do periodically flooded lakeshores, beaver ponds and other wet depressions.

The five general classes of wetlands in Ontario are bogs, fens, swamps, marshes and shallow open waters.

Bogs are characterized by peat and a surface carpet of mosses, mainly *Sphagnum*. Peat is dead plant matter which has accumulated for many years. The water table is at or near the ground surface in the spring and slightly below it during the rest of the year. The drainage of bogs is closed, that is, very restricted. Oxygen concentrations are low and the water is acidic; thus, decomposition is retarded and only certain plants can exist. Plants which have adapted to bog conditions are sphagnum moss, leatherleaf, sundew and

Waterlily. Wetland vegetation keeps the water clean.

pitcher plant. Black spruce is the dominant species in a treed bog. Treeless bogs frequently have a layer of shrubs such as cranberries and sweet gale.

Fens are similar to bogs and consist of decomposed peat of different thicknesses and they, too, have a restricted drainage system. Sedge is the predominant plant species although grasses and reeds can be found. Shrub cover is similar to that of the bog but the trees in fens are tamarack.

Black spruce bogs are a common feature in nothern Ontario but both bogs and fens are uncommon in southern Ontario. They develop under cold conditions where the short growing season for bacteria contributes to the incomplete decomposition of the peat. Thus, peatlands are remnants of the Ice Age.

Wooded wetlands, with standing to gently flowing waters, are called swamps. Here pools and channels are interspersed with hardwood and conifer stands (ash, tamarack, red and silver maple, black spruce), shrub thickets (alder, willow, dogwood, buttonbush), and a carpet of herbs and mosses. In some areas sphagnum moss is abundant. Swamp trees have massive root systems which develop superficially and do not penetrate deeply. In this way, they can meet the problem of anchorage in soft muck saturated with water.

Marshes are wetlands dominated by reedlike plants and grasses. Herbaceous or annual plants, such as cattails, rushes, arrowheads and water lilies, are abundant. Water levels vary and may reach a depth of two metres. Vegetation tends to be patchy and interspersed with channels and open water.

The fifth class of wetland, shallow open water, lies in wide flat basins and is a transitional stage between lakes and marshes. The water evaporates during the summer exposing large mudflats. The shorelines may be firm, soft or floating, and vary from rock or silt to organic deposits. Submergent and surface vegetation, such as wild celery, muskgrass, white water lillies and spatterdock, predominates.

Values of wetlands

Wetlands, with their complex chemical and biological systems, enhance and protect water quality in lakes and streams. Chemicals which may be deleterious are transformed to harmless compounds, thereby improving water quality. Wetlands account for 20 to 50 per cent of terrestrial denitrification, a process involving the return of nitrogen to the atmosphere.

During the growing season, large amounts of nutrients are taken up by plants. As a result, the water discharged in late spring and summer is low in nitrogen and phosphorous. These materials are not released until the fall, winter and spring runoffs. Consequently, algae are not able to grow since the required nutrients are not available during their growing season.

Wetlands act as settling and filtering basins, collecting silt and organic material and other pollutants. Vegetation slows the current, allowing suspended particles to settle out. This prevents silt from building up at downstream dams and reduces the need for dredging.

Wetlands protect the surrounding land with their special capacity to buffer the damaging physical impact of storm tides and waves. Where they exist they protect the shorelines of the Great Lakes and inland waters.

One hectare (2.47 acres) of peat and thick grasses can absorb and hold 3,200,000 litres (740,000 gallons) of water in a 1/3 metre (one foot) rise. This absorption capacity is especially important in urbanized areas where hard surfaces cause rapid runoff. Wetlands also help to maintain ground water and regulate stream flow, minimizing erosion on downstream banks.

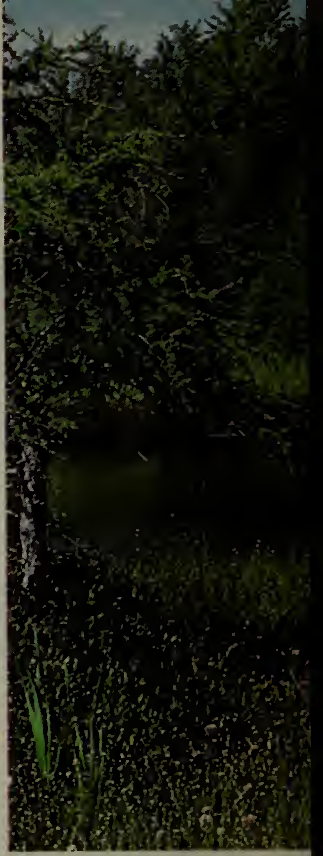
Wetlands are indispensable in wildlife and

How wetlands are lost,
perhaps forever by . . .

—Dredging
—Draining
—Ditching
—Developing (and filling)

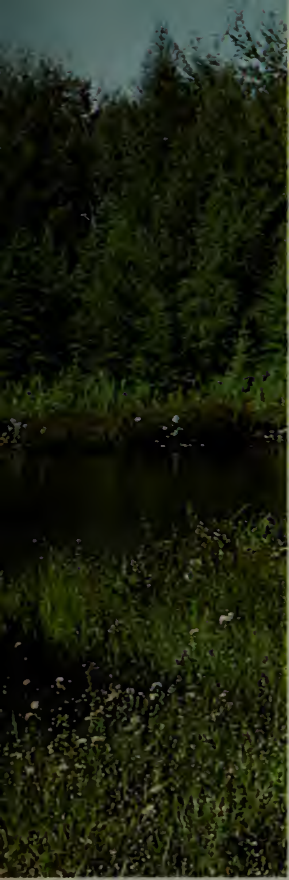
Swamp

Fen



The five clas

Bog veg



of wetlands

below

Marsh

Shallow open water

Wetland vegetation protects shorelines.

Midland painted turtle. Wetlands support wildlife populations.

fish production. Most animals must spend at least some part of the year in wetlands. Vital breeding, nesting, nursery and feeding needs are furnished by wetland habitats.

Loons, ducks and songbirds nest in wetlands. Migratory birds find resting places in wetlands, making it possible for birdwatchers to see rare birds such as the cattle egret, snowy egret, European widgeon, little gull and white-eyed vireo. Wetlands provide forage and homes for muskrat and beaver, and habitat and breeding areas for reptiles and amphibians. Bass, maskinonge, pike, sunfish and minnows spawn in their warm shallow waters.

An interspersion of vegetation types is the most important component of wildlife habitat. Edge, the interface between two different plant communities, determines the numbers and varieties of wildlife species present. The length and width of the edge determines population numbers and the type of edge accounts for wildlife diversity. The patchiness of the landscape makes it possible for species to avoid competition for food and breeding territories while finding refuge.

Wetlands produce valuable renewable resources—furs, peat, wild hay, wild rice, fish, thatching, watercress, timber, bait (minnows, frogs, and crayfish), cranberries and snapping turtles. In 1973, 2900 kg (6390 pounds) of snapping turtles were caught in Wye Marsh and sold for $2,200.

Ninety-five percent of all furbearers are taken in water. An average 10 ha (25-acre) marsh produces an average of 75 muskrat, one mink and two and one-half raccoons.

Waterfowl breed, feed and rest in wetlands. Up until 1973, Second Marsh in Oshawa was considered the largest banding station of its type in Ontario and the fifth largest in North America. Seven and one-half per cent of the waterfowl from the Atlantic Flyway were banded there—a total of 26,000 waterfowl in 17 years.

Wetlands are rich in plant and animal life and therefore ideal for scientific studies and educational field trips. Breeding and wintering ranges, migratory routes, hunting pressures, and sex and age groups of waterfowl may be determined. Man is able to develop new live-capture techniques for marking and recapturing furbearers. This is important in determining and maintaining populations.

The rewards associated with wild nature have increased in our technological society because our leisure time, real income, mobility and educational level have increased. People are looking to wild lands and waters

Trapping—an economic benefit provided by wetlands.

for emotional and spiritual experience, challenge and adventure, aesthetic enjoyment of natural settings, and escape from urban stresses and anti-social influence. All of these can be experienced in a wetland.

Birdwatching, photography, canoeing, nature interpretation and hiking are becoming popular. Hunting and fishing are important as pastimes for large numbers of people and as a source of income for some Ontario residents. All of these activities can be pursued in wetlands.

Management of wetlands

To improve or restore wetlands which have deteriorated through aging, filling or erosion, many techniques may be employed. Dry marshes can be reflooded by ditching; this improves the distribution of water while the spoil is piled along the ditch edge to accommodate nests and dens of wildlife. Artificial islands provide nest sites and reduce ground predation. The erection of nest boxes draws more waterfowl to the area.

Wetlands can be recreated to bring back the host of natural functions they once performed. Blasting with ammonium nitrate and fuel oil (ANFO) produces potholes and channels. Selective cutting, through dense areas of dead standing timber and shrubs, creates open water and clear shorelines.

To improve outdoor education, we need facilities like the Wye Marsh Interpretive Centre in Midland. This centre caters to visitors from a wide area and is visited frequently by school classes. With facilities such as boardwalks, displays and towers, this marsh can tell its own story, and nature interpreters take classes on regular schedules.

Enemies of wetlands

Agricultural drainage is the chief threat to wetlands. They are drained to increase crop yield and quality.

Industrial and housing developments are common threats. The building of highways, airports, marinas and harbours is detrimental to wetlands.

The reason why wetlands are under the gun is the change in land-use priorities. Urban planners are often insensitive to land quality and adopt policies approved by economists. Little attention is paid to the preservation of essential wildlife habitat.

Destruction of wetlands disrupts the ecosystem. Natural flood control is lost. Stream flows become irregular. Water tables are lowered. Soil erosion and sedimentation are increased. The peat deposits underlying wetlands become very dry and natural fire breaks are lost.

Water discharged from a drained marsh yields four to five times more phosphate and four to fifty times more nitrate-nitrogen than water from an uncultivated marsh. These fertilizers increase aquatic plant growth which clogs rivers and lakes and depletes the oxygen in the water. As a result the fish habitat is impaired or destroyed.

The destruction of wetlands entails predictable expenses. The community may now have to build artificial pollution controls and flood controls, maintain regular dredging, and look for a new water supply.

Friends of wetlands

For many years, agricultural land has been looked on as land worth protecting. Expressways, parkway belts, subdivisions and commercial and industrial developments have sometimes been prohibited to protect productive farm land. Agricultural lands are conserved for one purpose but wetlands with proper planning can accommodate multiple uses. Should they not be conserved as well?

Today non-profit organizations are active in wetland conservation. Ducks Unlimited is dedicated to the perpetuation and increase of North America's waterfowl. Its managers restore, conserve and create vital wetlands. The Federation of Ontario Naturalists publishes brochures and organizes field trips to increase public awareness of wetland values. The Ontario Federation of Anglers and Hunters has long urged the acquisition and maintenance of wetlands by the Ontario government.

Other agencies active in wetland protection are the Nature Conservancy of Canada, the Canadian Nature Federation and the Canadian Wildlife Federation. Together with a responsive public, these groups can help make the conservation of wetlands a reality.

It takes hundreds of years to establish a wetland community but only a few days to destroy it. If we cannot succeed in saving wetlands, we shall not be able to meet the greater challenge of safeguarding an environment that civilized man can inhabit.

The Moses-Saunders dam, no longer an obstruction to eels.—Photos by R. Ramsbottom.

The eel ladder

by W. R. Lannin, *Fish and Wildlife Supervisor, Cornwall District*
and P. Liew, *Biologist, Cornwall District*

BEFORE Europeans discovered this continent, thousands of young American eels, *Anguilla rostrate,* migrated annually up the St. Lawrence River into Lake Ontario.

Until 1959.

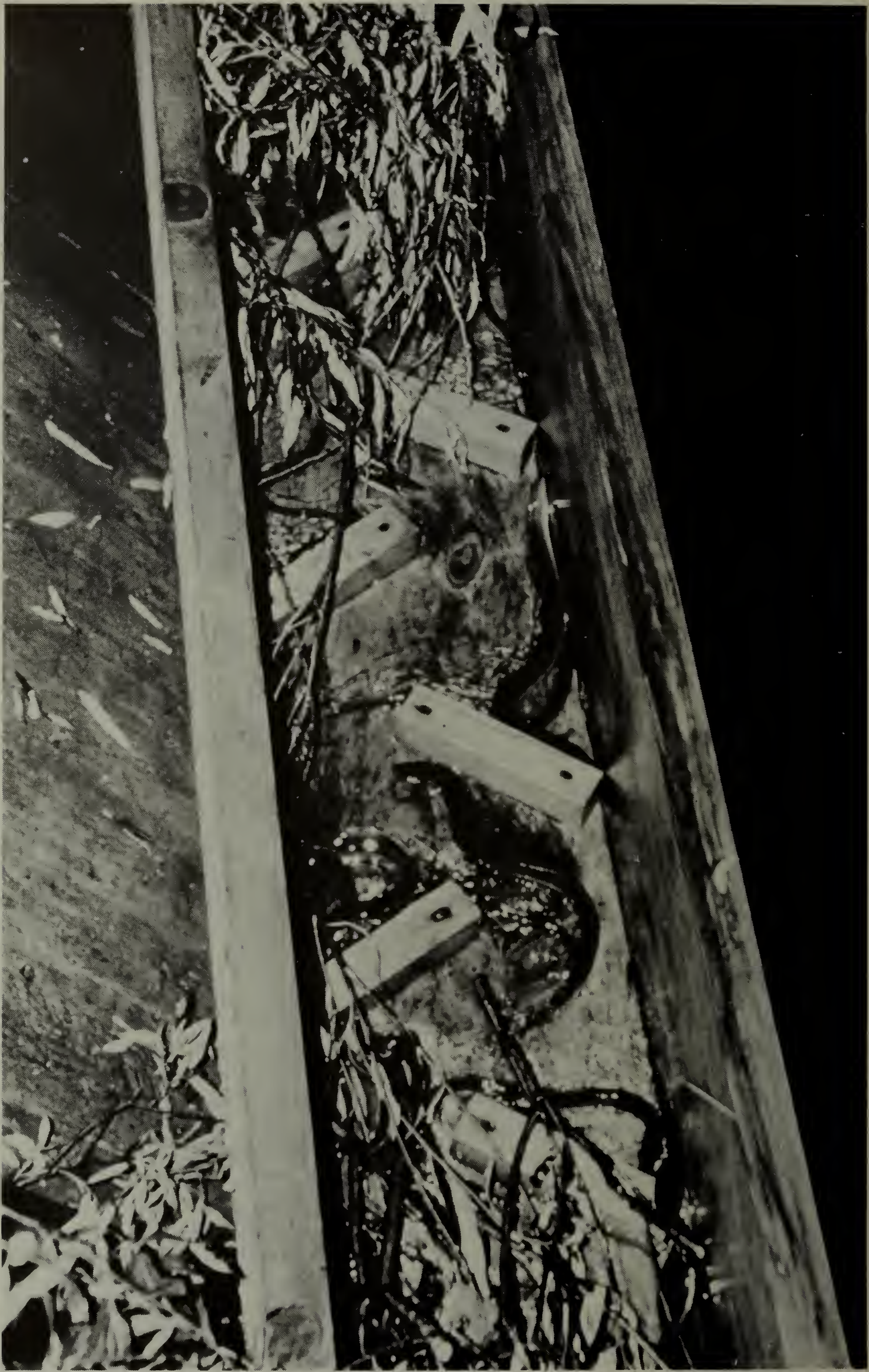
In that year Ontario Hydro completed the Moses-Saunders dam in the St. Lawrence River at Cornwall. It obstructed the natural migration of eels and thousands congregated from mid-June to mid-September at the foot of the dam. The traffic jam of eels in a small stretch of river led to strong competition for food and space and resulted in a stunted population.

Born in the Atlantic Ocean somewhere off the West Indies, the young eels make their way to the east coast of North America, ascend rivers and eventually reside in some mud-bottomed lake or river. Eels are found in the Ottawa River drainage and Lake Ontario. Since the opening of the Welland Canal, a few have been caught in Lakes Erie and Huron.

If the eels were somehow assisted to bypass the dam, their usual habitat would again be available in the upper St. Lawrence River and Lake Ontario. Better growth would result and the commercial eel fishery in eastern Lake Ontario would benefit.

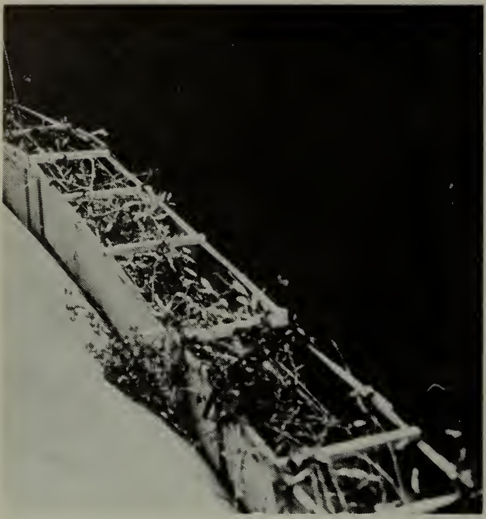
The congestion of eels in the tailwaters of the dam caused serious problems in any repairs of the dam's turbine housings. When the upper flow-control gate at head-water level was closed and the current through the turbine housing was stopped, eels swam into the housing before the lower water-control gate could be closed. When the water was pumped out of the housing, eels immediately clogged the pump intakes, making dewatering difficult, if not impossible.

To overcome these problems, a prototype eel ladder was designed in 1974 by Russ Whitfield, regional fisheries biologist at Kemptville, now retired. Building the ladder was a joint undertaking of the Ministry of Natural Resources, Ontario Hydro and the



Baffles slow down the current and vegetation gives the eels cover and leverage.

Up and over the dam—and then it's on to Lake Ontario.



The ladder rises on a 12-degree slope.

Fisheries Industrial Development Branch of the federal Department of the Environment.

The ladder is 236.2 m (775 feet) long. It zig-zags up the face of the ice chute eight and a half times and has rest pools at each return bend. The ice chute is a large opening through the dam extending down from the headwater to the tailwater to permit the passage of ice during spring breakup. This location does not interfere with the generation of electrical power.

Each trough section is 20.3 cm wide and 25.4 cm deep (8'' × 10'') built of 5.0 cm (2'') clear pine and spruce planking. Baffles are set in the bottom of each trough in a herring-bone fashion to slow down the water current. The trough sections are either affixed to the 70° slope of the concrete face of the ice chute with rawl plugs or suspended on cables from the top deck of the dam. The slopes of the ladder are maintained at about 12°.

To create more resting places, cover and leverage for the eels, green willow cuttings were stapled to the bottom of the troughs. These fresh cuttings required frequent replacement so commercial plastic vegetation was substituted.

Since eels find their way by seeking currents, they were attracted into the fishway at tailwater level by using a low-pressure hose to create turbulence in the water at the entrance. A similar hose was used to direct current upward at the crest to attract eels out of the fishway at headwater level. Eels swim into this current at the crest and fall through it into the forebay above the dam.

The eel ladder was usually operated from mid-June to mid-September or mid-October depending on the ambient temperatures. During the peak season, it carried as many as 24,000 eels a day. From 1974 to 1977, about 2.7 million eels ascended the ladder.

Before the ladder was installed, the eels were forced to remain downstream where they grew in size. And so during the first year of operation many of the eels ascending the ladder were large, but by the second year the majority were small, indicating the eels were passing up-river to Lake Ontario without prolonged delay.

To assess the impact of the ladder on this upstream population, 26,805 eels were tagged from 1975 to 1977. It is hoped these tags will be returned when the eels are mature enough to enter the commercial fishery.

Besides its economic contribution to the commercial eel fishery, the eel ladder is a tourist attraction, catching the eye with its unique design and giving visitors an opportunity to see numerous eels at close hand. It is also an excellent source of live specimens for researchers.

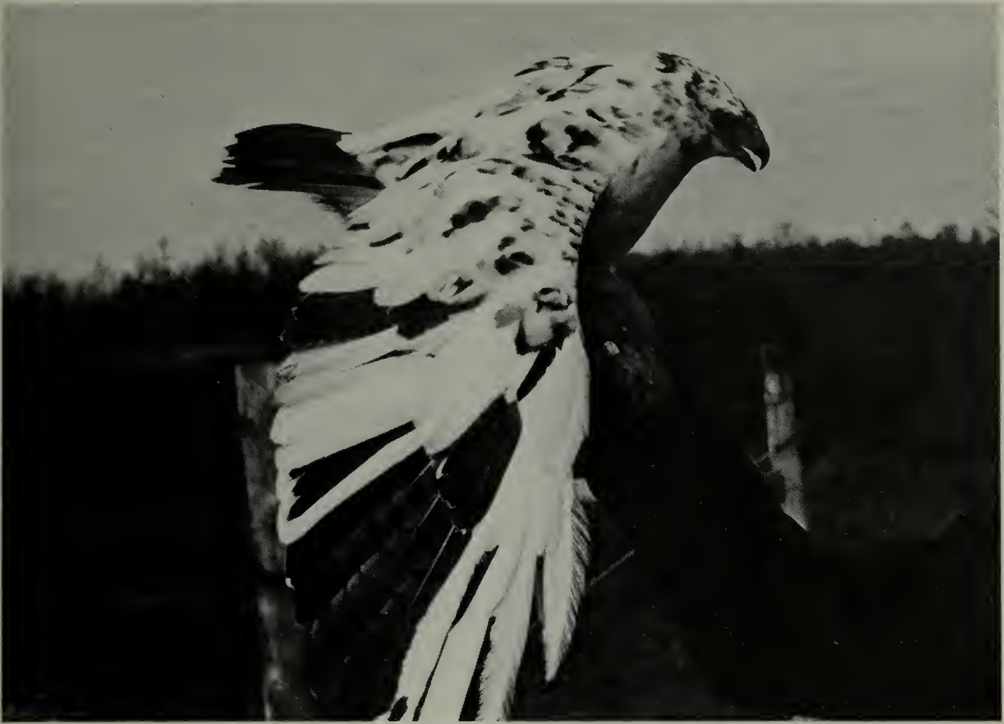
Mr. Whitfield's ladder has proved to be an effective and efficient means of moving eels over the Moses-Saunders Dam. It illustrates that in spite of our lack of foresight we can take steps to correct past mistakes.

REFERENCES

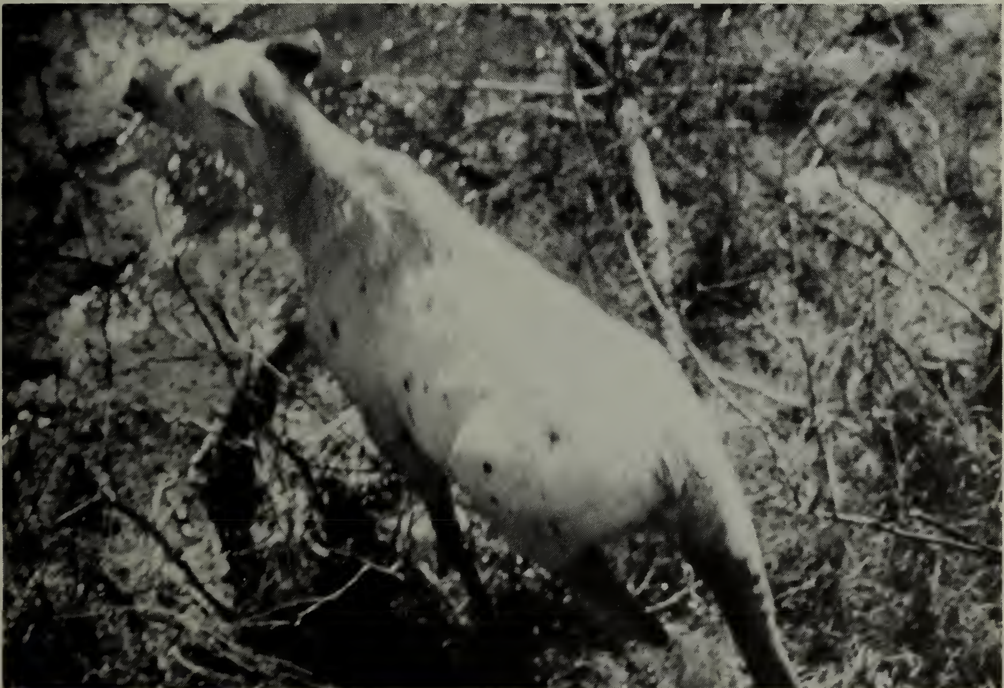
Whitfield, Russell E. and Dianne P. Kolenosky. 1978. Prototype Eel Ladder in the St. Lawrence River. Prog. Fish-Cult 40(4):152-154.

Commercial fish harvest

Ontario's commercial fish harvest in 1978 amounted to 22 118 000 Kg (49,153,000 pounds), valued at $15,412,000 (preliminary). The harvest was five per cent smaller than in 1977 but its value was six per cent higher.



A piebald (partial albino) eastern red-tailed hawk captured alive at Hawk Cliff Wildlife Agreement Area on November 12, 1978, by Gary Hubert (of St. Thomas), a member of the Hawk Cliff Raptor Banding Station Committee. Partial albinism is rare but examples have been found in many species of birds and mammals.



An albino moose in Cochrane District, photographed from air by Gary Brown.

Angling has become a family activity.

The sport fishery future in Ontario*

by F. P. Maher
Supervisor of Policy Development, Fisheries Branch

THE subject is an interesting challenge, allowing for scientific projection of known factors which affect the fishery, and also some flights of fancy. We have, perhaps, a unique situation in Ontario. On the one hand, we see promise that our labors in the Strategic Planning for Ontario Fisheries, or SPOF, will bear fruit and eventually result in greatly increased fishing opportunities. On the other hand, we see destructive forces at work—such as the transportation by air of contaminants—which threaten to have serious effects on our fisheries and over which we have little control.

There is a temptation to be optimistic about the positive things which can be done to enhance our recreational fisheries. At the same time, there is a gnawing doubt that we can succeed when so many destructive forces are beyond our immediate reach.

We are blessed in Ontario with an immense fishery resource. We have at least 250,000 lakes (up to 500,000 if you count small potholes down to one hectare in size) and many thousands of miles of streams. We have 88,000 square kilometres (34,000 square miles) of the Great Lakes alone. A further dimension is added to the extent of our fishery resource in that we have 139 species to manage.

In spite of the magnitude of this resource, we have supply problems. Out of our vast number of lakes, only 2,000 support populations of lake trout and less than half are good producers. In the past three decades, we have lost lake trout populations in 72 of these lakes, largely because of pollution, although overfishing was a factor in some.

Lake Erie is our best producer of commercial fish although several of its species have become extinct in the past few decades. The lake herring disappeared in the mid-1920s. By the mid '30s, the sauger had gone. By 1950 the lake whitefish had disappeared and by the mid '50s the blue pickerel no longer existed. The yellow pickerel, or walleye, was well down the road to disappearance when the mercury problem arose. Because of the high mercury content in these fish, commercial fishing had to cease and the population rebounded.

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* *Text of a paper given to the Canadian Sport Fisheries Conference, Fredericton, New Brunswick, October 2, 1978.*

Lake Erie is remarkable in that it continues to produce 16 to 18 thousand metric tons of fish a year in spite of the loss of prime species. However, the fishery today depends almost entirely on smelt and yellow perch. While the poundage yield from the lake has been maintained, the value of the fishery has declined because lower valued species are being harvested.

Heavy commercial fishing began to take its toll on Lake Superior at the turn of the century. The classical "fishing up" process was well demonstrated with more fish taken annually than the lake could produce on a sustained yield basis. This trend continued until the 1940s when the invasion of the sea lamprey wiped out the cold-water fishery. It is slowly recovering in Lake Superior because of the sea lamprey control program, massive stockings and a strict quota system. The cold-water fishery in Lake Ontario has faced a similar collapse.

Our most important inland lake is Lake Simcoe and it is in trouble. Our fisheries assessment unit on this lake has reported oxygen levels as low as two parts per million in some areas. The once clean lake trout spawning shoals are now covered in green mats of algae. Studies have shown that 45 per cent of the nutrients coming into Lake Simcoe are from domestic sewage, mostly treated, and from agricultural run-off.

The cold-water fishery in Lake Nipigon has also faced a serious decline. We considered at first this was due to the Ogoki diversion which had brought in silted water. However, the assessment unit, after study, concluded that it is due to overfishing.

I have given examples from our larger lakes simply because we have long-term data series to which we can refer. But we have similar problems with inland lakes in Ontario. We are faced with a rapidly eroding fisheries resource base and this bodes ill for

Caught in the act—destruction of stream habitat by diversion.

Caught in the act—land developers destroy stream habitat.

Fish fare badly in polluted waters.

the future of recreational fishing.

We have reason to believe the province is ready to take corrective action to solve some of the fishery problems just mentioned. These corrective actions involve a better information system which will allow us to take action quickly and effectively, a massive fish culture program to restore degraded fish stocks, more vigorous protection of the stocks we already have, a better use of genetics in managing our fish stocks, new policies which will allow us to protect the resource in spite of social and economic pressures to do otherwise—and much more.

I will not go through the litany of all the things we hope to accomplish with SPOF. But we think we will eventually restore many of the degraded fisheries of the province. If this happens, it bodes well for the future of recreational fishing.

The Great Lakes have a tremendous potential for angling that has scarcely been realized. Some critics have said that it will be extremely difficult to develop large recreational fisheries because these bodies of water are so large that anglers will not buy the large boats they need to go out on them. Our experience with the coho salmon fishery off Toronto leads us to believe otherwise. It would now appear, that if the resource is there, and reasonably abundant, the fishermen will find ways to harvest it.

The enthusiasm with which anglers have pursued coho salmon far off shore in Lake Ontario is amazing. Perhaps more amazing still is the proliferation of big water fishing gear and techniques over the past two or three years. Larger boats for venturing far off shore, down rigger gear for deep water trolling, and charter boats catering to fishing parties are now common.

If we succeed in restoring the fisheries of the Great Lakes with self sustaining species such as lake trout and rainbow trout, and perhaps supplemented with introduced species such as the coho and chinook salmon, I am sure the recreational fishermen will find ways and means of exploiting them.

In Ontario, much has been said about the preference of our citizens for species such as brook trout, rainbow trout, lake trout, bass, northern pike and muskellunge, while other species, such as carp, catfish, suckers and pan fish, go unharvested. In time, because of the pressure on our resources, it is thought that more and more of our citizens will begin to fish these less desired species.

Moreover, we have considerable numbers of people from Europe who are delighted to find good populations of carp, suckers and catfish along the Lake Ontario shoreline, close to large urban centres such as Toronto. These people turn up in large numbers to harvest these fish and appear to be surprised that native Canadians do not show much interest in them.

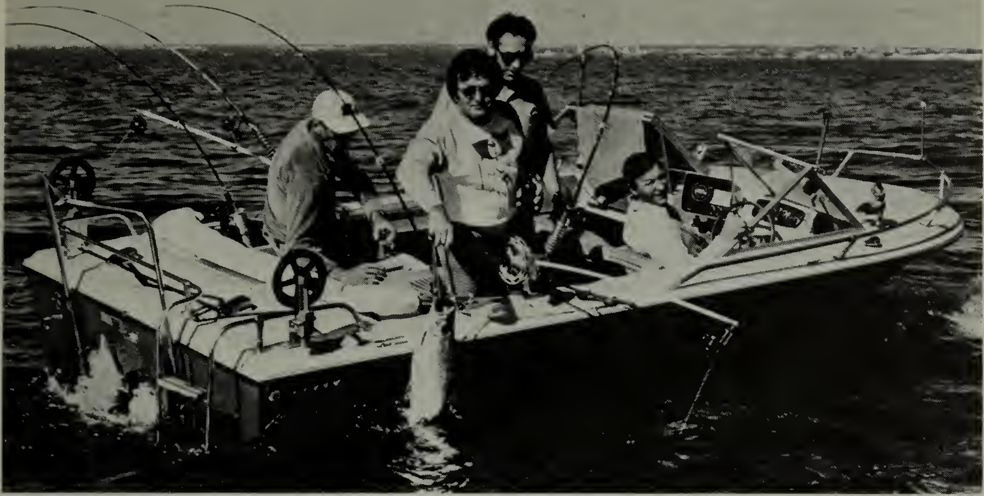
It would, therefore, be easy to suggest that in the future there will be a gradual shift towards the harvesting of those species which are not currently desired by most of our citizens. There is, however, some evidence this will not happen.

The second generation of the new arrivals seem to acquire a taste for traditional game fish species just as much as third and fourth generation Canadians. I have concluded that the principle emphasis in recreational fishing in the Great Lakes and our inland waters will continue to be on our established game fish.

Now for a less rosy view . . . Cottaging and camping are ways of life in Ontario. On Friday evenings the highways are crowded by the exodus to the country and crowded again on Sunday night as people return to the city. Much of our recreational fishing is done on weekends and at points some distance from the place of residence. If severe fuel rationing were imposed, people would not be as mobile as they are now and fewer people would be able to go fishing. Opportunities for recreational fishing in and around the major centres would not be able to meet the demand, and recreational energy would surely be diverted into other avenues.

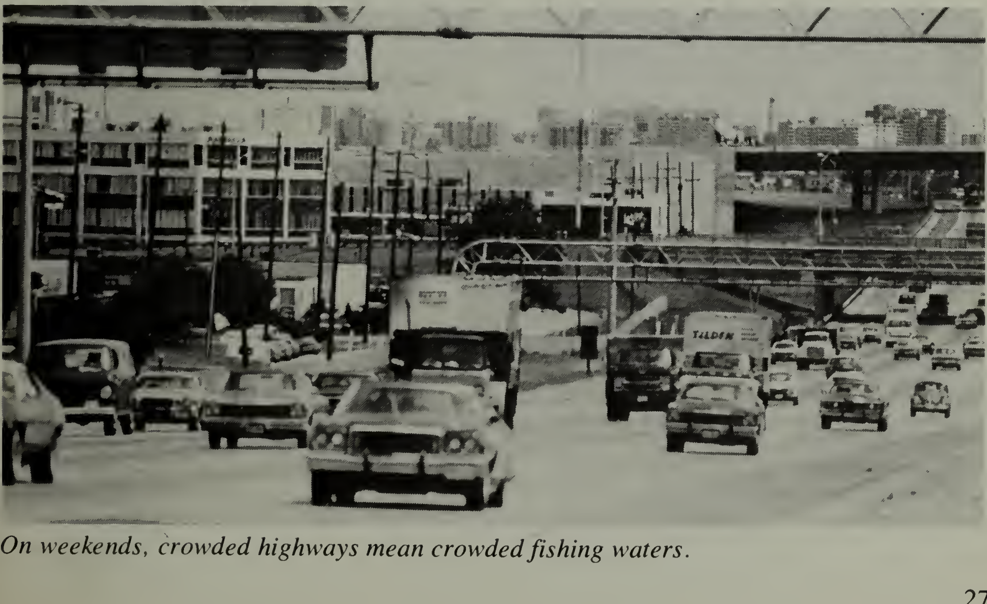
Another serious problem is acid rain. Even natural rainfall is slightly acidic due to carbon dioxide reacting with water to form carbonic acid. However, much stronger acids are formed when oxides of sulphur and nitrogen react with oxygen and water. These oxides are spewed into the atmosphere from the smelting of primary ores and the burning of fossil fuels. As rain and snow with increased acidity fall on water bodies and forests, fish populations and forest productivity decrease.

This problem is far more extensive than we thought. The large industrial areas in the United States around Gary, Indiana, and Chicago are also sending their airborne



Salmon fishing in Lake Ontario.

Angling can be restful as well as exciting.



On weekends, crowded highways mean crowded fishing waters.

blessings our way and causing the lakes in the Muskoka and Haliburton areas to become so acidic that fish populations are declining.

Natural rain has a pH of about 5.6 while rain in some of the affected areas has a pH of around 2.9. The Precambrian Shield extends from Nova Scotia to the mouth of the MacKenzie River and the rocks tend to be somewhat acidic. Natural buffering in the lakes, up until now, has been sufficient to maintain a pH suitable for most of our native species in spite of the acidic nature of the surrounding rocks. The addition of airborne pollutants has caused many of our lakes to use up their natural buffering and undergo a drastic drop in pH. Once the natural buffering is gone, it takes little added acidification to cause a collapse in fish populations.

The United States dumps about 30 million metric tons of sulphur dioxide into the air annually, while Canada contributes about six million metric tons. We are very much afraid that before the necessary international cooperation can be achieved and the immense undertaking of pollution control carried out, we will have lost fish stock from a great many of our lakes.

Studies are now being carried out to create models which will enable us to predict the collapse of our inland fisheries in the Muskoka and Haliburton areas. Attempts have been made to place limestone in inlet streams and to investigate other methods of reducing acidity. To date, very little of a useful nature has turned up.

And of course, we all know about contaminants other than acid rain. We have high mercury levels in the flesh of fish in many areas across the province. In Lake Ontario, the high levels of poly-chlorinated byphenols and mirex in some fish have caused our government to issue booklets warning the public about eating too many fish of certain sizes from certain areas.

Once discovered, effective action has been taken to restrict the entrance of many of these pollutants to the environment. Some contaminants are so widespread, however, it will be a long time before all sources of contamination are cleared up. It seems as though every day better methods of chemical analysis enable us to uncover some new pollutant which is a carcinogen, causes birth defects, or is detrimental to human health in some other way.

Good fishing on the doorstep of a big city.
—Photo by A. A. Wainio.

In spite of warnings, people continue to enjoy fishing for contaminated fish and even eat the fish. The coho salmon from Lake Ontario, for example, have levels of PCBs high enough to cause warning that these fish should be eaten only occasionally and never by women in their reproductive years.

Our conservation officers on creel census duties tell us that most of the people who capture these salmon are fully determined to eat them and consider warnings to be nothing more than alarmist tactics. I believe the State of New York ran into a similar problem when they banned recreational fishing in Lake Ontario for certain species. Public pressure eventually made them relax the ban.

I mentioned earlier that only 2,000 of our lakes support lake trout. They are deep, clear, cool lakes with limited productive shallow water areas and with relatively few fish species present. These lakes are the kind on which most people want to build cottages. In many cases they are already under stress due to airborne pollutants. The added stress of eutrophication caused by development could collapse the fishery.

The very act of land clearing causes an increase in phosphate run-off to the lakes. Cottagers have a habit of installing lawns and flower gardens, and bringing household pets. Nutrients from all of these sources eventually pass into the lakes. Even properly functioning septic tanks and tile beds eventually pass nutrients into the adjacent body of water.

One of the problems facing us, therefore, is to control access, and severely limit or prohibit development on these sensitive lakes. This is difficult to do with a growing population and an increasing demand for more cottages.

I am not quite sure whether we are going to end up with a profit or a loss in the next couple of decades. As an optimist, I would like to believe that we will end up on the plus side with the number of recreational fishing opportunities created by sound management far outweighing our losses due to stresses beyond our control. It would be interesting to look at these speculations at the Federal-Provincial Conference of 1998 to see just how close we came to foreseeing the future.